LearnHub – Full Stack Development Documentation (MERN Stack)

Project Name: LearnHub
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1. Introduction

LearnHub is an online learning platform designed to enhance digital learning by providing course content, tracking student progress, and enabling educators to create and manage educational material. This document outlines the full stack development process using the MERN stack.

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2. Technology Stack

- **MongoDB** – NoSQL Database for storing user, course, and progress data
- **Express.js** – Web application framework for Node.js
- **React.js** – Frontend JavaScript framework for building user interfaces
- **Node.js** – JavaScript runtime for building scalable backend services

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3. System Architecture

The LearnHub platform follows a decoupled architecture where the frontend and backend communicate via RESTful APIs.

Frontend (React.js) ⇄ Backend (Express.js + Node.js) ⇄ MongoDB

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4. Features Implemented

- User authentication and authorization (JWT-based)
- User registration and login (Student & Educator)
- Course browsing, filtering, and enrollment
- Educator course creation with multimedia upload
- Progress tracking and course completion
- Certificate generation upon course completion
- Admin panel for user/content management

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5. Key API Endpoints

- `POST /api/auth/register` – Register new users
- `POST /api/auth/login` – User login and token generation
- `GET /api/courses` – Get all courses

- `POST /api/courses` – Create a new course (Educator)
- `GET /api/users/profile` – Get user profile and progress
- `POST /api/enroll` – Enroll in a course
- `GET /api/certificates/:id` – Generate/download certificate

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6. Project Setup Instructions

1. Clone the repository from GitHub.
2. Install dependencies: `npm install` in both frontend and backend folders.
3. Create a `.env` file in the backend with your MongoDB URI and JWT secret.
4. Start backend: `npm run server`
5. Start frontend: `npm run dev` (using Vite or React Scripts)
6. Access the application at `http://localhost:5173/`

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7. Deployment

- Frontend deployed on Firebase Hosting
- Backend hosted on Render / Railway / AWS EC2

- MongoDB Atlas used for cloud-hosted database

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8. Advantages

- ✅ **Cross-platform Compatibility:** Built using React and Node.js which supports web and mobile use cases.
- ✅ **Scalability:** MongoDB and Node.js handle horizontal scaling effectively for large user bases.
- ✅ **Fast Development:** Reusability of JavaScript across frontend and backend speeds up development.
- ✅ **Modern UI/UX:** React ensures a dynamic, responsive, and smooth user interface.
- ✅ **Flexible Course Management:** Educators can dynamically create and update content.
- ✅ **Real-time Updates:** Easily extendable to support WebSockets for live interactions.

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9. Disadvantages

- ⚠️ **SEO Limitations:** React-based SPAs may struggle with SEO unless SSR or pre-rendering is implemented.
- ⚠️ **Initial Load Time:** Large React bundles can increase initial page load times.

- ⚠️ **Learning Curve:** Developers must be familiar with asynchronous JavaScript, MongoDB structure, and Express middleware.
- ⚠️ **Security Management:** Requires extra layers of protection for authentication and content access.
- ⚠️ **Third-party API Dependencies:** Failure or change in APIs may affect functionality.

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10. Future Scope

🚀 **Scalable Growth Ideas for LearnHub**:

- 🌐 Add support for more regional languages using i18n libraries.
- 📱 Launch a **mobile app** version using React Native.
- 🧠 Integrate **AI-based recommendations** for personalized course suggestions.
- 📹 Add **live class streaming** and **chat rooms** for student-instructor interaction.
- 📈 Analytics dashboard for students and educators to view performance metrics.
- 💳 Introduce **subscription models** and **payment gateway integration** (e.g., Razorpay, Stripe).
- 🎓 Collaborate with educational institutions for verified certificate issuance.

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11. Appendix

Term	Description
MERN Stack	MongoDB, Express.js, React.js, Node.js – full JavaScript-based web stack
JWT	JSON Web Token – used for securely transmitting user authentication data
REST API	Representational State Transfer – API design model used for client-server data
CI/CD	Continuous Integration/Continuous Deployment – for automating build & deploy
MongoDB Atlas	Cloud-hosted version of MongoDB database
Firebase	Platform used to deploy static frontend applications (React-based UI)